Independent Research Project

2020-02-17

Contents

Introduction

You have done several structured labs that provided opportunities to learn about R, RMarkdown, and several different aspects of climate science (data analysis and several computer models).
For the next few weeks, you will have a chance to utilize the skills you have learned thus far in lab to explore a research question pertaining to your specific interests. This series of labs consists of a written lab report in RMarkdown and a presentation to the class. For this project, you will choose a question or idea pertaining to one of the previous labs and explore the topic a deeper. This may consit of exploring the "why" portion of previous questions that only asked you to describe patterns in the data or it may be evaluating relationships between other variables not assesed in prior labs. To answer your question, you may use the any of the data from lab 2, the MODTRAN model, the RRTM model, the GEOCARB model, or a combination thereof.

Please get your topic approved by either Professor Gilligan or Ms. Best by Feb. 21.

The lab report for your project is **due Mar. 19 at 11:59 PM**.

Solo or Team Projects

You may choose to do this project individually or with a partner as a team effort. If you work with a partner, you may work together to design the question, obtain and analyze data, make a team presentation, and write a report together. We expect teams to include a note in the report that indicates which member contributed what to the report (this does not need to be super detailed and can say, "Alice and Bob designed the experiment together. Bob wrote the code to run the models. Alice wrote the code for the data analysis. Alice and Bob contributed equally to writing the discussion and conclusions.") This is similar to the requirement at many research journals that co-authored papers include a statement of what each author contributed.

Choosing a Topic

For undergraduates, we recommend that you choose a topic from one of the exercises that you did in labs #2–5 and think of a new question along the same lines as the questions that exercise asked. For graduate students, we expect you to try something more ambitious than just simple extensions of the questions from the lab exercises, but it is still fine to take one of the lab exercises as a starting point.

If you want to do something really different than what we have done previously in lab, that is fine. But check with one of us to make sure your plan is appropriate and feasible (we don't want you to bite off more than you can chew).

Be CrEaTiVe! Now is the time to really explore parts of the class that you have found interesting and present your findings in a unique, exciting way.

Writen Report (Due Mar. 19)

Your report should be comprehensive, yet not overly verbose. One recommendation for achieving this is to create an outline to organize your thoughts before initializing writing and data analysis. The report needs to include the following components:

- Introduction
  - *Provide background information that frames the problem you are addressing. At the end of the introduction, the reader should understand exactly* ***what the problem is*** *that you are addressing and why that problem is* ***interesting*** *and* ***relevant*** *to the climate system.*
- Methods
  - *Describe the methods for answering your question. The methods section should be written such that someone completely unfamiliar with your project could follow your steps and recreate your results.*
  - This section should contain the R code you use to do the analysis:
    - Getting data into R: download from the internet, read it in from files on your computer, run models, etc.
    - Process data to clean it up: use functions like `mutate`, `gather`, `summarize`, etc. to convert the data into a useful form.
    - Analyze data: anything you do to analyze the data, such as generating descriptive statistics like the mean or standard deviation, fitting linear models to get slopes (rates of change), etc.
- Results
  - *Describe the results of your analyses. Include apropriate charts, tables, graphs, and other quantitative representations of data.*
  - This section should have R code for making graphs, tables, etc.

- Conclusions/Discussion
  - *Discuss the implications for the results you found using data from your results section.*
    - Why are these results significant or interesting?
    - What data supports these conclusions?
    - What are the broader implications of these results?
    - From the results that you have found, what are the next steps to take in this line of research? What other questions have arisen as a result of your analyses?
- Works Cited
  - *Include a works cited section to credit the research and thoughts that are not your own. Be sure to use citations throughout your report where necessary.*
  - We will post a separate document that explains how to do citations and bibliographies in RMarkdown.

Final reports are to be pushed to your Lab 6 Github repository *no later than 11:59 PM on Mar. 19*. **You must push the .Rmd file *and* the knitted PDF** to Github. A portion of your final report grade will reflect effective use of R/RMarkdown/Github, the clarity and succinctness of your writing, visual representations of data, appropriate discussion of results, and insights into future analyses.

Making PDF output from RMarkdown

To make PDF output from RMarkdown, you need to install a program called "LaTeX" (pronounced "layteck", rhyming with "tech"). I describe how to do this on "Tools" section of the class web site, but I will summarize here: The easiest way to install LaTeX for RMarkdown is to use the `tinytex` package in R. To do this, execute the following commands at the RStudio console:

```
install.packages("tinytex")
library(tinytex)
install_tinytex(extra_packages=c("mhchem", "mathptmx"))
```

This may take 5-10 minutes to complete, so you probably want to wait until a time when you won't need your computer for a bit before you do it.

```
An alternative, but which is more involved and will use more space
would be to install the [MikTeX package](https://miktex.org) from
[miktex.org](https://miktex.org). Instructions for doing this are
the [Tools](https://ees3310.jgilligan.org/tools/#installing-latex)
             class web site.

            # Presentation (Mar. 30)

            I have moved the due date for the presentation to
            Mar. 30 and I am giving you two options.
```

```
Whichever option you take (written or recorded video),
on the presentation date Mar. 30, not the
report due date.

1. You and your team can coordinate a recorded video p
minutes per person about your presentation.

* You may use any software that you're comfortable wit
presentation.
```

- Powerpoint has a recorder that will let you to record yourself giving a powerpoint presentation. However, this is not set up well to record multiple people in different places jointly recording a presentation, so it's best if you are doing your project by yourself.

```
To use the recorder, open the "Slide Show"
menu (see the figure below), select "Use presenter vie
"Record slide show"

![Powerpoint slide show menu](_images/lab_06/record_pp

Then you will see the presenter view, as shown below.

![Powerpoint recording presenter view](_images/lab_06/

You will see your slide show with a video inset showin
your webcam (if you have one). After you click on the
Powerpoint will record your voice narration and video
as well as the slideshow.

You can click on "pause" if you need to pause partway
through to collect your thoughts.

You can draw on the slides by clicking on the pen or h
at the bottom of the screen.  You can also use your mo
pointer to point at things on your slideshow  by right
the "Pointer options" menu, and choosing "Laser pointe

When you're done, click the "Stop" button at the top o
```

  screen.

  You can play back your slideshow by clicking "From the beginning" in the "Start slideshow" are at the left of the slideshow menu.

  The video and audio narration will be stored in the powerpoint file when you save the presentation.

- If you want to use different software to record yourself giving your slideshow, that's fine too.

```
* Brightspace has a tool called "Kaltura capture" for
and screens and you can learn more here:
  <https://www.vanderbilt.edu/brightspace/how-do-i-use

* You can also use Zoom:

  * Start a Zoom meeting with your partner or partners
microphones, and enable video if you want to have vide
from your team's webcams as you make your presentation
```

  - Next, the person who started the meeting should do the following steps:
    * start the powerpoint presentation
    * Then, go to the Zoom window, click "Share Screen", and share the powerpoint presentation window.

      Now everyone on the meeting can see the Powerpoint window.
    * Finally, go back to the Zoom window and click "Record" to start recording.
    * Be sure you have Zoom configured to record to your computer, not the cloud.

      This is because their cloud processors are backed up from all the people using Zoom, so there may be a very long delay (a whole day or more) before the video is ready to download.
  - Now you can go to the Powerpoint window and do your presentation. It will be recorded on Zoom.
    * If you want to transfer control of the Powerpoint window to a pertner on the Zoom call, there are instructions here: https://support.zoom.us/hc/en-us/articles/201362673-Request-or-Give-Remote-Control

      Here is a summary: a partner on the Zoom call can click on the "View options" menu on the shared Powerpoint window and click "Request remote control" and then the person who started the meeting can allow remote control.

      Alternately, the person who started the meeting can initiate this and click the "Remote Control" button at the bottom of the Zoom meeting screen and give remote control to the partner.

      When the partner is done with remote conntrolling the presentation, they can click the "View Options" menu and select "Give up Remote Control."

      You can tell the remote control status because when you are remotely controlling someone else's shared screen, the title at the top of the window turns from green (for passively viewing) to yellow and says "You are controlling *so-and-so*'s screen", where *so-and-so* is the person's name.

- When you're done, Zoom will process the video and save it on your computer. * After you're done recording your presentation, upload it to Box and share the Box folder with Professor Gilligan and Ms. Best. As an optional alternative, you can upload it to YouTube and send the link to Professor Gilligan and Ms. Best.

2. The other option, instead of recording a video, is to write a short (roughly 2 page, double-spaced) press release to accompany your report.

   Your report has the format of a formal scientific report, with an introduction, methods, results, discussion, and conclusions. The press release should be a description of your project for the general public. It should have the following:

   1. Start by briefly describing the important result (what you found out from your project) and make it sound exciting or interesting in one or two sentences. This is what journalists call the *lede*: The first sentence of a story should grab the reader and make them want to read more. Write in the third person, so something like, "A team of students at Vanderbilt University discovered . . . "

   2. Next, back up and introduce the research team (names and other information about yourselves that the reader might be interested in, such as your major, if you're a first-year, sophomore, etc.), describe the research question you are investigating, and explain why someone would be interested in it.

      ```
      3. Now that the reader knows your quesiton and why they might b
      in it, you can describe what you found out and what its signifi
      This should be the bulk of your press release. Try to make your
      question and the answer you found relevant to people's lives by
      ```

      them to aspects of climate change that someone in the general public may be thinking about.

   3. Finally, you can describe very briefly and in very general terms that are accessible to someone who doesn't know much about climate change what you did to answer the question (this should *not* have technical detail; it should be a very general description in simple language).